QUARTERLY JOURNAL

OF THE

Royal Meteorological Society

Editor:

P. A. SHEPPARD (January)

T. W. WORMELL (April-October)

Vol. **79** 1953

LONDON :
ROYAL METEOROLOGICAL SOCIETY
49 CROMWELL ROAD, S.W.7
1953

CONTENTS OF VOLUME 79

PAGE

EDITORIAL 1

REVIEWS OF MODERN METEOROLOGY—8. Atmospheric electricity; some recent trends and problems—T. W. Wormell 3

SIR CHARLES NORMAND—PRESIDENTIAL ADDRESS—Atmospheric ozone and the upper-air conditions 39

P. D. THOMPSON—On the theory of large-scale disturbances in a two-dimensional baroclinic equivalent of the atmosphere 51

R. S. SCORER—Theory of airflow over mountains : II – The flow over a ridge .. 70

O. BJÖRGUM—On the velocity, temperature, and humidity profiles in the lower atmosphere 84

R. S. SCORER and F. H. LUDLAM—Bubble theory of penetrative convection (Plate I) 94

B. J. MASON—The growth of ice crystals in a supercooled water cloud (Plate II) .. 104

A. C. BEST—Condensation nuclei and the development of radiation fog .. 112

W. J. GIBBS—A comparison of hemispheric circulations with particular reference to the western Pacific 121

G. REYNOLDS—Rainfall at Bidston 1867-1951 137

Shorter Contributions—

H. PANOFSKY—The variation of the turbulence spectrum with height under super-adiabatic conditions 150

C. L. JORDAN—A comparison between observed and geostrophic winds in low latitudes 153

I. C. BROWNE—Radar echoes at vertical incidence from a horizontally stratified atmosphere 157

Correspondence—

R. HIDE—Some experiments on thermal convection in a rotating liquid.. .. 161

H. ARAKAWA—Clear-air turbulence near the jet stream 162

K. L. CALDER—Note on the derivation of the logarithmic velocity profile .. 163

E. L. DEACON; H. PANOFSKY—Wind profiles and the shearing stress 164

E. L. HAWKE; L. C. W. BONACINA; G. M.—*Snow Survey of Great Britain*, 1949-50, 1950-1 168

A. W. BREWER—Impactor technique for the measurement of cloud particles .. 171

Proceedings at meetings of the Society 172

Reviews 174

Compendium of Meteorology, Amer. Met. Soc. (P.A.S.); *Climatological Atlas of the British Isles* (C.W.B.N.); *Notos*, South African Weather Bureau, Vol. 1, No. 1, 1952 (R.C.S.); *Relations entre les phénomènes solaires et géophysiques, Problèmes de Géomagnétisme* (H.W.L.A.); *Observer's Handbook*, Meteorological Office (A.W.B.); *Conference on Water Resources*, Ed., R. Hanson (H.L.P.); *Climateand the British Scene*, G. Manley (R.M.P.); *Physical Geography*, P. Lake (J.M.C.); *Annual Report of the Director of the Meteorological Office*, 1951-2 (R.S.S.); *Die Meteorologische Tagung in Bad Kissingen Oktober* 1951 (R.J.M.); *Atmospheric pollution – its origins and prevention*, A. R. Meetham (O.G.S.); *The Canterbury Project; a New Zealand radio-meteorological investigation, D.S.I.R.* (J.K.B.); *Reports on progress in Physics*, XV, Physical Society, *Advances in applied mechanics*, II, Eds., R. von Mises and T. von Kármán (P.A.S.)

Corrigenda to Vol. 78 182

Obituary Notices 183

REVIEWS OF MODERN METEOROLOGY—9. Climatic variation – Gordon Manley 185

F. A. BERSON—A quantitative analysis of large-scale patterns with special regard to the effect of eddy motion 210

G. K. BATCHELOR—The conditions for dynamical similarity of motions of a frictionless perfect-gas atmosphere 224

R. MURRAY and S. M. DANIELS—Transverse flow at entrance and exit to jet streams 236

G. MANLEY—The mean temperature of central England, 1698-1952 242

D. H. MCINTOSH—Annual recurrences in Edinburgh temperature 262

P. R. BROWN—Climatic fluctuation in the Greenland and Norwegian seas .. 272

PAGE

Shorter Contributions—

R. M. Goody—Equations of transfer for the total flux of terrestrial radiation .. 282

M. G. El-Fandy—On the physics of dusty atmospheres 284

Correspondence—

J. S. Malkus; R. S. Scorer and F. H. Ludlam—Bubble theory of penetrative convection 288

O. Björgum—The derivation of the logarithmic velocity profile 292

J. Clodman—Critical values of the Richardson number 293

S. Gregory; R. S. Read; G. Reynolds—Rainfall at Bidston, 1867-1951 294

Discussions 296

F. H. Ludlam—Orographic cirrus clouds (*Q.J.*, **78**, p. 554); J. S. Sawyer—A study of the rainfall of two synoptic situations (*Q.J.*, **78**, p. 231); R. D. Roper—Evening waves (*Q.J.*, **78**, p. 415); (a) P. A. Sheppard, H. Charnock and J. R. D. Francis—Observations of the westerlies over the sea (*Q.J.*, **78**, p. 563), (b) P. A. Sheppard and M. H. Omar—The wind stress over the ocean from observations in the Trades (*Q.J.*, **78**, p. 583)

Proceedings at meetings of the Society 305

Reviews 309

The earth; its origin, history and physical constitution, H. Jeffreys (F.J.S.); *Die Ionosphäre*, K. Rawer (J.A.R.); *Plant environment and the grower*, S. A. Searle (R.W.G.); *Numerical analysis*, D. R. Hartree (F.H.B.); *Propagation of short radio waves*, Vol. 13, *M.I.T. Radiation Lab. Ser.*, Ed., D. E. Kerr; *The use of radar at sea*, Ed., F. J. Wylie (A.C.B.); *The tropical rain forest*, P. W. Richards (G.S.P.H.); *Bulletin de l'Observatoire du Puy de Dôme, Geofisica e Meteorologia* (T.W.W.)

Obituary Notices 314

Corrigendum 316

Reviews of Modern Meteorology—10. Convection in the atmosphere—F. H. Ludlam and R. S. Scorer 317

J. Smagorinsky—The dynamical influence of large-scale heat sources and sinks on the quasi-stationary mean motions of the atmosphere 342

W. L. Godson—The evaluation of infra-red radiative fluxes due to atmospheric water vapour 367

E. E. Adderley—The growth of raindrops in cloud 380

K. H. Soliman—Rainfall over Egypt 389

Shorter Contributions—

R. C. Wanta—The onset of turbulence in an elevated layer near sunrise .. 398

D. H. Johnson—A further study of the upper westerlies; the structure of the wind field in the eastern North Atlantic and western Europe in January 1950 .. 402

G. W. Hurst—The profile of a jet stream observed 1 September 1952 407

D. P. McIntyre—Organization of kinetic energy realized in the atmosphere .. 411

C. V. Smith and A. G. Forsdyke—Some downstream effects associated with large-amplitude troughs in upper flow patterns 414

Correspondence—

S. E. Ashmore; G. Reynolds—Rainfall at Bidston, 1867-1951 418

A. J. Whiten; G. Manley—World-wide distribution of pressure 419

Discussions—

Fair weather cumulus—

A. H. Yates—Atmospheric convection; the structure of thermals below cloud-base; D. G. James—Fluctuations of temperature below cumulus clouds (Plate III); L. Welch—Thermals as seen by glider pilots; F. H. Ludlam—The sub-cloud layer over land 420

A. C. Best—Condensation nuclei and the development of radiation fog (*Q.J.*, **79**, p. 112); W. E. Saunders—Some further aspects of night cooling under clear skies (*Q.J.*, **78**, p. 603); B. J. Mason—The growth of ice crystals in a supercooled water cloud (*Q.J.*, **79**, p. 104); (a) R. Wexler—Theory of the radar upper band (*Q.J.*, **78**, p. 372), (b) I. C. Browne—Precipitation streaks as a cause of radar upper bands (*Q.J.*, **78**, p. 590) (Plate IV) 437

TABLE OF CONTENTS

PAGE

Report of the Council for 1952 445

Proceedings at meetings of the Society 453

Reviews 457

Micrometeorology, O. G. Sutton (G.D.R.); *The theory of homogeneous turbulence*, G. K. Batchelor (O.G.S.); *Thermal diffusion in gases*, K. E. Grew and T. L. Ibbs (S.C.); *A century of London weather*, W. A. L. Marshall (E.L.H.); *Arch. Met. Geophys. Biokl. B*, **3** (G.A.B.); *Arch. Met. Geophys. Biokl.* A, **4** (G.A.B.); *Berich. Deutsch. Wetterd. U.S. Zone*, No. 42 (G.A.B.); *Météorologie générale, Tome I : Structure verticale de l'atmosphère. L'atmosphère et les phénomènes de rayonnement*, J. Roulleau and R. Trochon (G.D.R.); *Soil physical conditions and plant growth*, Ed. B. T. Shaw (H.L.P.); *Altimeter errors near mountains*, R. S. Scorer (R.J.M.)

Obituary Notices 462

Corrigenda 462

Sir Charles Normand—Presidential Address—Monsoon seasonal forecasting .. (Plate V) 463

T. W. Wormell—Symons Memorial Lecture—Lightning 474

B. J. Mason and R. Ramanadham—A photoelectric raindrop spectrometer .. 490

R. M. Goody and C. D. Walshaw—The origin of atmospheric nitrous oxide .. 496

B. J. Mason—On the generation of charge associated with graupel formation in thunderstorms 501

E. K. Bigg—The formation of atmospheric ice crystals by the freezing of droplets 510

R. W. Longley—The length of dry and wet periods 520

Shorter Contributions—

E. E. Austin—Upper winds of Aden 528

J. Neumann—On a relation between the annual heat budgets of seas and lakes and other terms of the energy equation 532

J. R. D. Francis and H. Stommel—How much does a gale mix the surface layers of the ocean ? 534

D. S. Cooke—The duration of wet and dry spells at Moncton, New Brunswick .. 536

S. Gregory—A note on the classification of annual rainfall-distribution types .. 538

J. R. Scott—On wind analysis in low latitudes 544

C. E. Wallington—A lee-wave scale 545

C. G. Webb—Solar radiation at Singapore 547

Notice—

Evaporation records at Camden Square—J. Glasspoole 548

Correspondence—

I. C. Browne; R. Wexler—The collection efficiency of ice crystals 549

P. Barratt and I. C. Browne—A new method for measuring vertical air currents .. 550

Discussions 551

T. W. Wormell—Symons Memorial Lecture—Lightning (*Q.J.*, **79**, p. 474);
D. H. McIntosh—Annual recurrences in Edinburgh temperature (*Q.J.*, **79**, p. 262);
P. R. Brown—Climatic fluctuation in the Greenland and Norwegian seas (*Q.J.*, **79**, p. 272);
G. Manley—The mean temperature of central England, 1698-1952 (*Q.J.*, **79**, p. 242)

Proceedings at meetings of the Society 568

Reviews 570

Hilfsbuch für raum und au senklimatische Messungen, F. Bradtke and W. Liese (D.B.); *Essentials of fluid dynamics*, L. Prandtl (H.C.); *Handbook of statistical methods in meteorology*, C. E. P. Brooks and N. Carruthers (D.H.M.); *The upper atmosphere*, S. K. Mitra (B.H.B.); *Barometrographia* (E.L.H.); *The British Caribbean Meteorological Service, First Annual Report* (R.G.V.); *Das Wetter und seine Ursachen*, H. J. aufm Kampe (A.G.F.); *Reviews of research on arid zone hydrology*, UNESCO (H.L.P.); *Essai sur l'hydrologie superficielle au Sahara*, J. Dubief (H.L.P.); *Report of the Desert Locust Survey and Control, Oct.* 1950-*Dec.* 1952, E. Africa High Commission Desert Locust Survey (S.T.A.M.)

Obituary Notices 575

Corrigendum 576

Index 577

NOTICE—The Royal Meteorological Society does not accept any responsibility for the views and opinions expressed by individual writers in the *Quarterly Journal*.